

WHAT IS CLAIMED IS:

1. A method for analyzing optical properties comprising:  
generating a local oscillator signal;  
5 applying a first modulation to at least a portion of said local oscillator signal;  
applying said local oscillator signal with said first modulation to a device  
under test (DUT);  
receiving said local oscillator signal having said first modulation; and  
optically mixing said received local oscillator signal with a second signal.  
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2. The method of claim 1 further including processing electrical signals from  
said receiving and mixing to characterize a group delay property of said DUT.
3. The method of claim 1 further including processing electrical signals from  
15 said receiving and mixing to characterize an amplitude property of said DUT.
4. The method of claim 1 wherein applying said first modulation includes at least  
one of phase modulating, polarization modulating, and intensity modulating at  
least a portion of said local oscillator signal.  
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5. The method of claim 1 wherein said second signal is generated by applying a  
second modulation to at least a portion of said local oscillator signal and  
further including combining said portion of said local oscillator signal having  
said first modulation with said portion of said local oscillator signal having  
25 said second modulation before said receiving and mixing.
6. The method of claim 5 wherein said first modulation is applied in response to  
a first electrical signal and said second modulation is applied in response to a  
second electrical signal, said first electrical signal and said second signal  
30 having different frequencies.

7. The method of claim 1 further including electrically mixing an electrical signal generated from said receiving and optical mixing with a different electrical signal.
- 5 8. The method of claim 1 wherein applying said first modulation includes polarization modulating at least a portion of said local oscillator signal and further including processing electrical signals from said receiving and mixing to determine elements of the Jones matrix.
- 10 9. The method of claim 1 wherein applying said first modulation includes polarization modulating at least a portion of said local oscillator signal and further including processing electrical signals from said receiving and mixing to characterize differential group delay.

10. A system for analyzing optical properties comprising:  
a local oscillator source for generating a local oscillator signal;  
a modulation controller configured to provide a first electrical signal at a first frequency;
- 5 a first optical signal modulator optically connected to modulate at least a portion of said local oscillator signal in response to said first electrical signal;  
a device under test (DUT) interface in optical communication with said first modulator; and  
a system, in optical communication with said first optical signal modulator and  
10 said DUT interface, for receiving said local oscillator signal that is modulated in response to said first electrical signal and optically mixing said received local oscillator signal with a second signal.
11. The system of claim 10 further including a processing unit in signal  
15 communication with said receiving and mixing system configured to process an electrical signal to characterize a group delay property of a DUT that is optically connected to said DUT interface.
12. The system of claim 10 further including a processing unit in signal  
20 communication with said receiving and mixing system configured to process an electrical signal to characterize an amplitude property of a DUT that is optically connected to said DUT interface.
13. The system of claim 10 wherein said first optical signal modulator is one of a  
25 phase modulator, a polarization modulator, and an intensity modulator.

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14. The system of claim 10 further including a second optical signal modulator optically connected to modulate at least a portion of said local oscillator signal in response to a second electrical signal from said modulation controller and an optical combining unit in optical communication with said DUT interface and said second optical signal modulator for combining said local oscillator signal that is modulated in response to said first electrical signal with said local oscillator signal that is modulated in response to said second electrical signal.
15. The system of claim 14 wherein said first electrical signal and said second electrical signal have different frequencies.
16. The system of claim 10 further including an electrical mixer that is configured to electrically mix a different electrical signal with an electrical signal generated from said local oscillator signal that is modulated in response to said first electrical signal.
17. The system of claim 10 wherein said first optical signal modulator is a polarization modulator and wherein said receiving and mixing system includes a polarization diverse receiver.
18. The system of claim 17 further including a processing unit in signal communication with said receiving and mixing system configured to process an electrical signal to determine elements of the Jones matrix.
19. The system of claim 17 further including a processing unit in signal communication with said receiving and mixing system configured to process an electrical signal to characterize differential group delay.

20. A system for analyzing optical properties comprising:  
a local oscillator source for generating a local oscillator signal;  
a first modulator optically connected to modulate at least a portion of said  
local oscillator signal;  
5 a device under test (DUT) interface in optical communication with said first  
modulator;  
a second modulator optically connected to modulate at least a portion of said  
local oscillator signal; and  
an optical receiver in optical communication with said first modulator, said  
10 DUT interface, and said second modulator, said optical receiver configured to receive  
and optically mix said local oscillator signal having said first and second modulations.
21. The system of claim 20 further including a processing unit in signal  
communication with said optical receiver, said processing unit configured to  
15 process an electrical signal received from said optical receiver to characterize  
a group delay property of a DUT that is optically connected to said DUT  
interface.
22. The system of claim 20 wherein said test signal modulator is a polarization  
20 modulator and wherein said optical receiver is a polarization diverse receiver,  
said system further including a processing unit in signal communication with  
said polarization diverse receiver configured to process electrical signals from  
said polarization diverse receiver to characterize a differential group delay  
property of said DUT.

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